Lighting Controls

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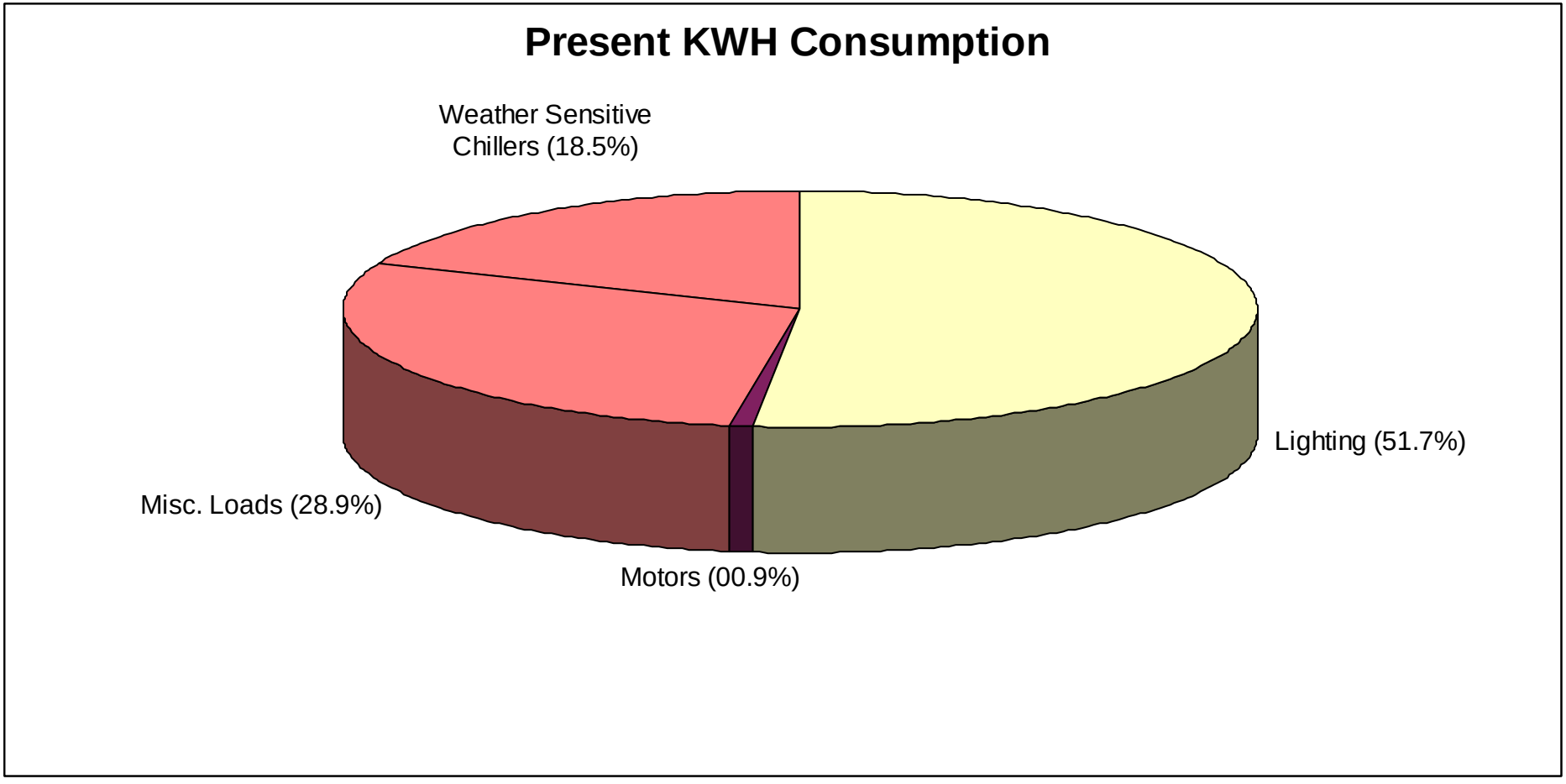
Why Fool With Lighting Controls?

30-70% of a building's electrical usage and frequently over 50% of associated electrical cost is lighting loads

Benefits of Lighting Controls

- –Energy savings
- –Increased convenience
- –Increased comfort
- –Increased safety
- –Reduction in maintenance costs
- –Compliance with building and energy codes

Typical Office Building Consumption Loads



Types of Lighting Controls

- Manual operation
- Remote Relay operation
- Occupancy based feedback operation
- Dimming operation

Existing Building Retrofits

- Manual
- Relay
- Occupancy Sensors
- Dimming Technology
  - Emerging Technology, DALI Addressable Ballasts
  - Future Technology, MEMS

Manual Lighting Controls

Advantages

- Simple
- Least expensive
- Universally Understood
- Easy to Maintain

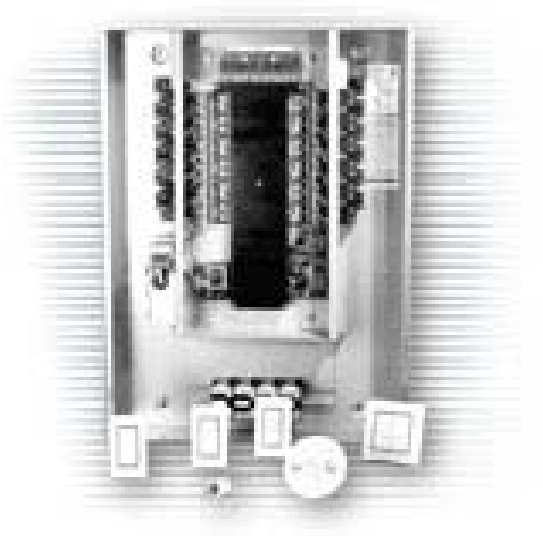
Limitations

- Operators not Reliable
- Continuous Operator Re-education required to Obtain Some Savings
- Not Easily Reconfigurable
- Can Not Automatically Manage Over lit Conditions
- Can not Take Advantage of Daytime Rate Profiles

Relay Lighting Controls

Advantages

- Fairly Simple
- Reliable (old technology)
- Can be integrated to BAS
- Increases life of lighting system
- Energy savings



Limitations

- Not Easily Reconfigurable
- Can Not Automatically Manage Over lit Conditions
- Can not Take Advantage of Daytime Rate Profiles without Significant User Impact
- Expensive if trying to control small zones to improve benefits

Occupancy Sensor Lighting Controls

Advantages

- Fairly Simple
- Reliable (mature technology)
- Significant energy savings

Limitations

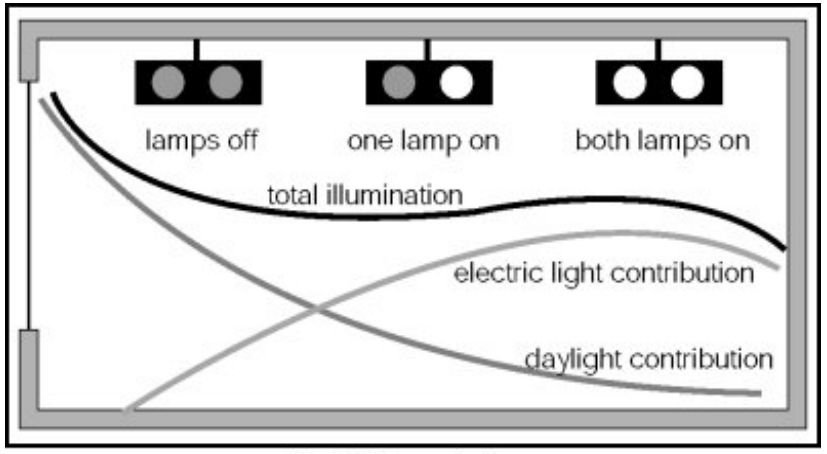
- Not Easily Reconfigurable
- Sensing field not well understood
- Not Always occupant friendly
- Does not manage over lit conditions
- Can not Take Advantage of Daytime Rate Profiles
- Not easily integrated to BAS
- Can reside on top of relay controls
- Can decrease bulb life
- Increased maintenance costs

Dimming Technology

Dual level switching Controls (Typically Used With Day lighting)

Advantages

- Simple
- Old technology
- Fair energy savings*



Daylighting controls

Limitations

- Users not reliable*
- Usually does not Automatically Manage Over lit Conditions
- Usually does not Take Advantage of Daytime Rate Profiles
- Not easily integrated to BAS
- Requires multiple but standard ballasts

Dimming Technology

Wall or Desk Top User Lighting Controls

Advantages

- Fairly Simple
- Newer technology
- Better energy savings*

Limitations

- Users not reliable*
- Not Well Understood
- Lots of desk top remotes/batteries to track
- Usually does not Automatically Manage Over lit Conditions
- Can not Take Advantage of Daytime Rate Profiles
- Not easily integrated to BAS
- Frequently used with other desktop load controls
- Requires special ballasts

Dimming Technology

Dimming Ballasts w/photosensor controls

Advantages

- No User Interaction
- New technology
- Auto-adjusting for Bulb Depreciation
- significant energy savings

Limitations

- Not Well Understood / commissioning issue
- Automatically Manages Over lit Conditions
- Can Take Advantage of Daytime Rate Profiles if connected to BAS
- Requires different ballasts
- Not be easy to reconfigure

Dimming Technology

Dimming Ballasts w/DALI Protocol and BAS Interface

Advantages

- Newest technology
- Easy to reconfigure
- Automated repair information
- The Most Energy saving system

Limitations

- Not Well Understood
- Initial costs
- Automatically Manages Over lit Conditions
- Will take advantage of Daytime Rate Profiles
- Requires different ballasts

Intelligent Technology

Dimming Ballasts w/MEMS Integration (Typically Using Multiple Inputs)

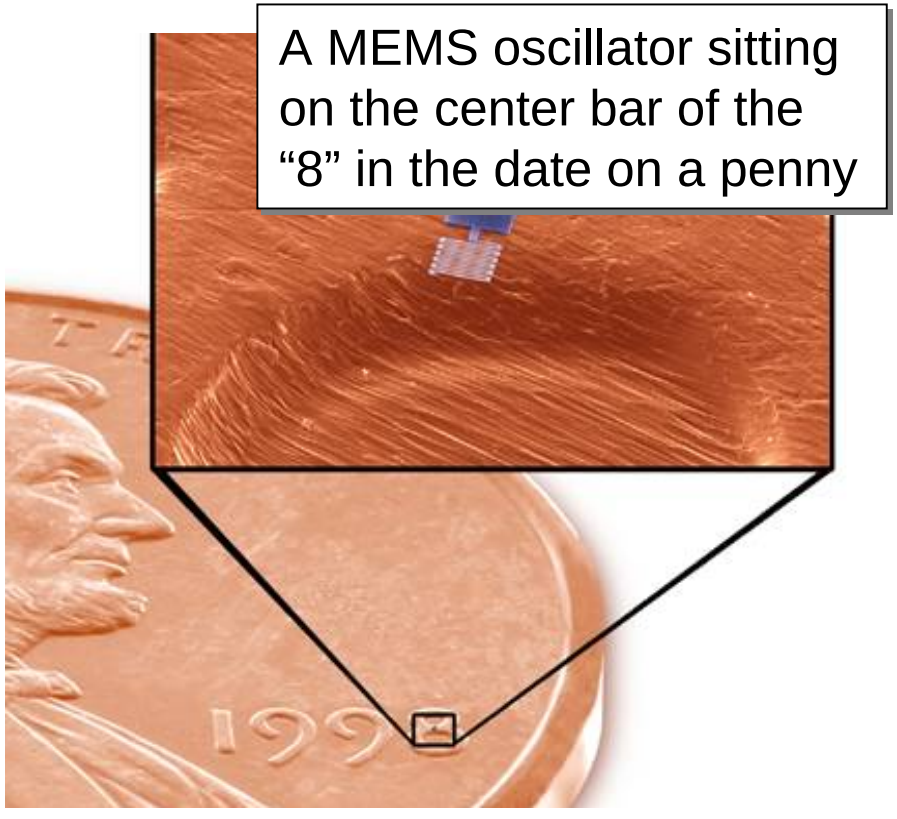
Advantages

- Future Technology
- Maximum Interlaced Energy saving system
- Easy to reconfigure
- Automated repair information
- Intelligent Interactive Building Systems

Limitations

- Not Yet Available
- Initial costs
- Automatically Manages Over lit Conditions
- Will take advantage of Daytime Rate Profiles because it is connected to BAS
- Requires Special ballasts
- Requires Complete Building Integrated Systems

What is MEMS Technology?



- **MEMS** = **M**icro-**E**lectro **M**echanical **S**ystems
- Integrates processors, sensors, communication and intelligence
- Follows standard IC/CMOS manufacturing process
- Matured technology currently available
- Cheap as Chip

Micro-systems for Buildings

- Sensor suite
- Intelligent processing
- Wireless
- Plug-n-play
- No plug power

Micro- comfort system

- Temp.
- RH
- Pressure
- Flow
- Light
- Sound
- Gases

Micro- protection system

- Smoke
- Fire
- Flame
- Biological
- Chemical

Micro- security system

- Micro- security cameras
- Intelligent tracking and tagging
- Biometrics
- Remote identification

Typical Lighting Control Applications

Typical Lighting Control Applications			
Type of Control	**Private Office**	**Open Office - Daylit**	**Open Office - Interior**
Occupancy Sensors	++	++	++
Time Scheduling	+	++	++
Daylight Dimming	++	++	0
Bi-Level Switching	++	+	+
Demand Lighting	+	++	++

++ = good savings potential
+ = some savings potential
0 = not applicable

Typical Cost Impacts

Operating Cost Comparison Open Office Area, 1000 sq. ft.					
Performance	**Base Case**	**Time Scheduling**	**Occupancy Sensors**	**Daylighting**	**Time Scheduling + Daylighting**
Annual Energy Use[a]	5700 kWh	5100 kWh	5000 kWh	4200 kWh	3700 kWh
Annual Energy Cost	$340	$305	$300	$250	$220
Annual Energy Cost Savings	—	**$35**	**$40**	**$90**	**$120**

So many Choices… What is the best solution?

Importance of Your Lighting Development Team

- Determine which area's lighting controls would be applicable
- Determine interaction of existing or upgraded lighting components impact
- Data logging may be required to minimize savings calculations risk
- Define which technology is most appropriate for each area type and occupant interaction
- Life Cycle Cost Evaluation for best Product Application Selections